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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/666,671	09/17/2003	Hongqin Shi	P118-US	8251

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EXAMINER	
VINH, LAN	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 05/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/666,671	SHI ET AL.	
	Examiner	Art Unit	
	Lan Vinh	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-80* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-80* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *101204*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claim 15 is objected to because of the following informalities: In line 1 of claim 15, "100" appears to be a typographical error, the examiner suggests replacing "100" with --1--. Appropriate correction is required.

Double Patenting

2. Claim 4 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 2. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 22-25, 26-29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 22 and 23 "around 25^0 degree" is vague and indefinite as the basis for the degree is not provided. Similarly, In claims 24-25, "is 1%" and "is 20 %" are vague and indefinite as the basis for the percentage is not provided

Claim 25 recites the limitation "the predefined value" in claim12. There is insufficient antecedent basis for this limitation in the claim.

Claim 26 is indefinite for the use of improper Markush language, the examiner suggests replacing "a group" with --the group--. Claims 27-29 are indefinite because they depend on claim 26

For the purpose of examination, "around 25^0 degree" is best understood by the examiner as 25^0 degree C. "is 1%" and "is 20 %" are best understood as percentage of the etchant concentration.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-8, 10-15, 26-27 are rejected under 35 U.S.C. 102(b) as being anticipated by Tai et al (US 6,436,229)

Tai discloses a method for etching. The method comprises the steps of:

loading a microstructure into an etch chamber of the etch system, wherein the microstructure comprises a polysilicon/sacrificial material and one or more structural materials (col 8, lines 10-30)

providing a spontaneous vapor phase etchant recipe to the etch system (col 4, lines 19-22; fig. 1A)

providing an additional amount of the etchant recipe to the etch system at a time that is determined based on a measurement of an amount of an etchant/chemical species (col 4, lines 57-60)

The limitations of claims 2, 4 have been discussed above

Regarding claim 3, Tai discloses producing an etching volatile by-product (col 3, lines 30-31)

Regarding claims 5-6, Tai discloses using xenon difluoride (col 9, lines 32-33)

Regarding claims 7-8, Tai discloses that the etchant comprises BrF3 (col 4, lines 57-58)

Regarding claims 10, 11, Tai discloses introducing nitrogen/diluent into the chamber (col 4, lines 19-21)

Regarding claim 12, Tai disclose the step of adding the xenon gas/etchant to the chamber when the dilute ratio of the etchant is measured (col 4, lines 57-58)

Regarding claims 13-14, Tai discloses the step of preparing the etchant in vapor reservoir 120/exchange chamber and supplying the etchant through a loop that passes through the etch chamber 110 (fig. 1A)

Regarding claim 15, Tai discloses performing etching in pulses (col 5, lines 64-66), which reads on repeating the etching steps

Regarding claims 26-27, Tai discloses forming metal layer of Al and Cu on the silicon wafer (col 8, lines 19-21)

6. Claims 30-40, 44-45, 48 are rejected under 35 U.S.C. 102(b) as being anticipated by Zhang et al (6,162,585)

Zhang discloses a method of etching. The method comprises the steps of loading a microstructure into an etch chamber of an etching system and providing an etchant recipe to the etch chamber over time (col 4, lines 48-50), wherein an amount of the etchant recipe per time unit varies (Table 2)

Regarding claim 31, Zhang discloses using vapor etching (col 5, lines 9-10)

Regarding claims 32-34, Zhang discloses providing a first amount of the etchant recipe at a first time; and providing a second amount of the etchant recipe at a second time,wherein the first amount equals the second amount (col 5, lines 20-27)

Regarding claims 35-36, Zhang discloses providing a third amount of the etchant recipe at a third time, wherein the interval between the first time and the second time does not equal the interval between the second time and the third time (Table 2)

Regarding claims 37-39, Zhang discloses measuring the flow rate/concentration of the etchant and adjusting the amount of the vapor etchant based on the flow rate (table 2)

Regarding claim 40, Zhang discloses using vapor HF/interhalogen (col 5, lines 9-10)

Regarding claims 44-45, Zhang discloses using nitrogen in the etching step (Table 2)

Regarding claim 48, Zhang discloses that the structural layer remains after the polysilicon/sacrificial material is removed (fig. 4E)

7. Claims 53-56, 60-62 are rejected under 35 U.S.C. 102(b) as being anticipated by Zhang et al (6,162,585)

Zhang discloses a method of etching. The method comprises the steps of: providing an etchant recipe to the etch chamber over time (col 5, lines 39-45), wherein an amount of the etchant varies when a change of measured flow rate/concentration of the etchant (Table 2)

The limitation of claim 54 has been discussed above

Regarding claims 55-56, 60, Zhang discloses using vapor HF/interhalogen (col 5, lines 9-10)

Regarding claims 61-62, Zhang discloses using nitrogen in the etching step (Table 2)

8. Claims 72-80 are rejected under 35 U.S.C. 102(b) as being anticipated by Tai et al (US 6,436,229)

Tai discloses a method for etching. The method comprises the steps of: collecting a plurality of data of flow rate/concentration of the etchant/ parameter that characterizes an etching process using an etchant recipe and storing the collected data in a mass flow control (col 5, lines 30-38), etching a microstructure using the etchant recipe based on the collected flow data (col 5, lines 39-50)

Regarding claims 77-78, Tai discloses using xenon difluoride (col 9, lines 32-33)

Regarding claims 74-76, Tai discloses that the etchant comprises vapor BrF3 (col 4, lines 57-58)

Regarding claims 79, 80, Tai discloses introducing nitrogen/diluent into the chamber (col 4, lines 19-21)

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tai et al (US 6,436,229) in view of Zhang et al (US 6,162,585)

Tai method has been described above. Unlike the instant claimed invention as per claim 9, Tai using a vapor etchant recipe comprises of BrF3 instead of HF

Zhang discloses a method for etching using vapor HF (col 5, lines 39-40)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Tai by using vapor HF etching as per Zhang because Zhang discloses that the allowable duration of vapor HF etching allows deeper etch (col 5, lines 63-67)

11. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tai et al (US 6,436,229) in view of Chinn et al (US 6,666,979)

Tai method has been described above. Unlike the instant claimed invention as per claims 16-17, Tai fails to disclose coating the microstructure with a SAM and the etchant has a pressure from 0-15 Torr

Chinn discloses a method for dry etch comprises the step of etching using the etchant has a pressure from 10-12 Torr and coating the microstructure with a SAM (col 11, lines 18-45)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Tai method by coating the microstructure with a SAM to prevent stiction during handling and using an etchant has a pressure from 10-12 Torr to produce only a few monolayers on the substrate as taught by Chinn (col 11, lines 16-19; lines 45-46)

12. Claims 18-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tai et al (US 6,436,229) in view of Han et al (US 6,740,247)

Tai method has been described above. Unlike the instant claimed invention as per claims 18-21, Tai fails to disclose that the diluent gas has a partial pressure from 20-700 Torr/ 50-100 Torr/500-700 Torr

Han discloses a method for HF vapor cleaning/etching comprises the step using a nitrogen /diluent gas has a partial pressure from 10-500 Torr (col 7, lines 55-57)

One skilled in the art at the time the invention was made would have found it obvious to modify Tai method by using a nitrogen/diluent gas has a partial pressure of 10-500 Torr to enable stabilization of the operating chamber pressure as taught by Han (col 7, lines 55-58)

13. Claims 22-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tai et al (US 6,436,229) in view of Fayfield et al (US 6,299,724)

Tai method has been described above. Unlike the instant claimed invention as per claims 22-23, Tai fails to disclose that the etchant/diluent has a temperature around 25^0 C

Fayfield disclose a method for enhanced HF etch process comprises the step of performing the HF etching process at 20-100^0 C (col 6, lines 10-14)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Tai by having the etchant/diluent at a temperature as per Fayfield because Fayfield disclose that the HF etching process temperature may range from about 20-100^0 C (col 6, lines 1-14)

Unlike the instant claimed inventions as per claims 24-25, Tai fail to disclose the specific etchant concentration percentage

Fayfield also discloses that the gas mixture ratio my be varied from 0-100% (col 6, lines 6-8)

Thus, one skilled in the art at the time the invention was made would have found it obvious to select any gas mixture ratio in order to achieve an optimized value for the gas mixture ratio.

14. Claims 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tai et al (US 6,436,229) in view of Chen et al (US 6,159,851)

Tai method has been described above. Unlike the instant claimed invention as per claims 28-29, Tai fails to disclose that the structural material comprises a metal nitride

Chen discloses a method for forming a semiconductor device comprises the step of forming a TiN layer with a primary conductive layer (col 6, lines 4-6)

Thus, one skilled in the art at the time the invention was made would have found it obvious to modify Tai by forming a metal nitride as per Chen because Chen discloses that the TiN provides conformal adherent coating on a lower metal (col 5, lines 14-16)

15. Claims 41-43, 57-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (US 6,162,585) in view of Tai et al (US 6,436,229)

Zhang method has been described above. Unlike the instant claimed inventions as per claims 41-43, 57-59, Zhang fails to disclose using an etchant comprises of XeF2 and BrF3

Tai discloses a method for etching comprises the step of etching using XeF2 and BrF3 (col 3, lines 26-28)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Zhang method by using an etchant comprises of XeF2 and BrF3 as per Tai because Tai discloses that diluting xenon gas with BrF3 controls the etching surfaces roughness produced (col 3, lines 26-28)

16. Claims 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (US 6,162,585) in view of Han et al (US 6,740,247)

Zhang method has been described above. Unlike the instant claimed invention as per claims 46-47, Zhang fails to disclose that the diluent gas has a partial pressure from 20-700 Torr

Han discloses a method for HF vapor cleaning/etching comprises the step using a nitrogen /diluent gas has a partial pressure from 10-500 Torr (col 7, lines 55-57)

One skilled in the art at the time the invention was made would have found it obvious to modify Zhang method by using a nitrogen/diluent gas has a partial pressure of 10-500 Torr to enable stabilization of the operating chamber pressure as taught by Han (col 7, lines 55-58)

17. Claims 49-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (US 6,162,585) in view of Chen et al (US 6,159,851)

Zhang method has been described above. Unlike the instant claimed invention as per claims 49-52, Zhang fails to disclose that the structural material comprises a elemental metal and a metal nitride

Chen discloses a method for forming a semiconductor device comprises the step of forming a TiN layer with a primary conductive layer (col 6, lines 4-6)

Thus, one skilled in the art at the time the invention was made would have found it obvious to modify Zhang method by forming a metal nitride as per Chen because Chen discloses that the TiN provides conformal adherent coating on a lower metal (col 5, lines 14-16)

18. Claims 63-71 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tai et al (US 6,436,229) in view of Winningham et al (US 6,518,194)

Tai discloses a method for etching. The method comprises the steps of: collecting a plurality of data of flow rate/concentration of the etchant/ parameter during a first etching for first series of sample/first microstructure using an etchant recipe (col 5, lines 30-38; col 7, lines 43-45), storing the collected data in a mass flow control (col 5, lines 30-38), which reads on determining a variation profile of the parameter in the first etch process, etching another series of sample (col 7, lines 45-46)

Unlike the instant claimed invention as per claim 63, Tai fails to specifically disclose the step of etching a second microstructure in a second etching process using the etchant recipe based on the collected data of the parameter in the fist etching process

Winningham discloses a method for transferring nanoscale pattern comprises the step of etching a second sample/microstructure in a second etching process using the etchant recipe based on the collected data of the parameter in the fist etching process (col 13, lines 55-58)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Tai method by etching a second sample/microstructure in a second etching process using the etchant recipe based on the collected data of the parameter in the fist etching process in order to determine the time needed to etch through the sample as taught by Winningham (col 12, lines 52-55)

Regarding claims 68-69, Tai discloses using xenon difluoride (col 9, lines 32-33)

Regarding claims 65-67, Tai discloses that the etchant comprises vapor BrF3 (col 4, lines 57-58)

Regarding claims 70-71, Tai discloses introducing nitrogen/diluent into the chamber (col 4, lines 19-21)

Conclusion

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 571 272 1471. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LV
May 11, 2005